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A Review of Two Rare Pine Snakes from the Gulf Coastal Plain

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A combination of fortuitous circumstances and the efforts of certain professional colleagues have enabled me to assemble a small series of pine snakes from the central Gulf Coastal Plain. These, representing two different members of the genus *Pituophis*, are the forms to which the names *lodingi* and *ruthveni* have been applied. Both have remained rare in collections despite vigorous field work, especially in the state of Louisiana. The infrequency with which they have been found is indicated by the fact that the acquisition of a single specimen from a new locality has, on several occasions, been the inspiration for a contribution to herpetological literature.

It has long been my intention to review the eastern members of this genus in collaboration with Robert G. Hudson, of Philadelphia. Although we undertook an extensive borrowing campaign a few years ago and accumulated an impressive mass of data, our commitments of late and in the foreseeable future are such as to preclude the possibility of completing our monograph with any degree of dispatch. Rather than delay the entire project indefinitely, I attempt herewith to summarize the present status of our knowledge of the two rarer forms, *lodingi* and *ruthveni*.

Names of institutions and private collections containing specimens discussed in this paper are as follows:

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A.M.N.H., the American Museum of Natural History
C.A., Chicago Academy of Sciences
C.C., Clemson College
C.M., Carnegie Museum
J.P.K., J. P. Kennedy, Houston, Texas; private collection
K.U.M.N.H., Kansas University Museum of Natural History
L.M.K., Laurence M. Klauber, San Diego, California; private collection
L.S.U.M.Z., Louisiana State University Museum of Zoology
M.C.Z., Museum of Comparative Zoölogy
M.G.F.M., Mississippi Game and Fish Commission Museum, Jackson, Mississippi
M.S.C., Mississippi Southern College
U.A.D.B., University of Alabama Department of Biology
U.M.M.Z., University of Michigan Museum of Zoology
U.S.N.M., United States National Museum

Pituophis melanoleucus lodingi Blanchard

BLACK PINE SNAKE

HISTORY: Blanchard described *lodingi* in 1924 (p. 532), naming it for the (now) late Dr. Henry Peter Löding, well-known naturalist of Mobile, Alabama. Blanchard had been aware of the black *Pituophis* for several years, for he published a note on it in 1920. In the absence of pattern, he had to rely upon scutellation, and the scale characters fell within the range of variation of both *melanoleucus* and *sayi*. No other *Pituophis* had been recorded at that time from the central Gulf coastal area, but Blanchard, chiefly on geographical grounds, assigned his specimens to *melanoleucus*. Later, when he described the form in 1924, it was as a full species, *Pituophis lodingi*.

In her review of the genus, Stull (1940, p. 79) listed *lodingi* as a subspecies of *melanoleucus*, and most subsequent authors have followed her usage. Almost all recent references to the black pine snake, however, have been little more than mere mentions in check lists and keys. Reports from the states in which *lodingi* occurs are as follows: *Alabama*: Löding (1922, pp. 30–32, locality records; the Blanchard 1920 paper is quoted in its entirety); Haltom (1931, pp. 46–47, pl. 15, lists both *lodingi* and *mugitus* and gives Mobile, Tuscaloosa, and Baldwin counties as Alabama records but does not state which race comes from which county); Chermock (1952, p. 60, in key). *Louisiana*: Viosca (1948, p. 2, and 1950, p. 11, listed only). *Mississippi*: Cook (1943, pp. 22–23, detailed description and reported from two Mississippi localities; 1954, p. 15, a slightly condensed repetition of the 1943 reference).

The names of Blanchard and Löding are inexorably linked with the black pine snake, not only through the formality of its scientific name,

but also because of their observations and writings about it. Löding supplied the specimens and the field notes, and Blanchard, an authority of considerable stature in the herpetological profession, recorded them. Before his untimely death in 1937 at the age of 49, Blanchard assembled additional data on *lodingi* in his files. Among them was a partially completed manuscript reporting on two additional specimens and from which Stull (1940, pp. 80-81) has quoted. Through the courtesy of Dr. Howard K. Gloyd and Dr. Frieda Cobb Blanchard I have had access to Blanchard's files on *lodingi*, and pertinent information abstracted from them is mentioned in a number of places below.

MATERIAL: All the specimens of *lodingi* that I could find have been examined and studied. There probably are others in one or more collections that I have overlooked, but several of the persons mentioned in the Acknowledgments have gone to considerable trouble to help ferret out additional material. Some specimens, known to Blanchard and Löding, have disappeared (see notes accompanying locality records), but Blanchard fortunately included descriptions, scale counts, and sex for two of them in his notes. These data I have added to my own columns of counts and measurements; I have also included Stull's figures (1940, p. 78) for a specimen from Theodore.

A complete list of the records and specimens I have been able to assemble, arranged in accordance with their localities, is as follows:

ALABAMA

Clarke County

16 miles east of Coffeeville (U.A.D.B. No. 56-1)

Mobile County

No definite localities within county (M.C.Z. Nos. 22373, 29215)

Abbott's Station, about 14 miles southwest of Mobile (U.S.N.M. No. 62340)

College Hill (U.M.M.Z. No. 84458)

Dawes (Blanchard, MS; Stull, 1940, p. 81)

Grand Bay (Blanchard, 1920, p. 31)

Irvington (Löding, 1922, p. 30; Blanchard, MS)

Between Irvington and Grand Bay (U.M.M.Z. No. 58800, type)

Mobile (C.C. No. 160; U.S.N.M. No. 75292)

10 miles west of Mobile (A.M.N.H. No. 74739)

Theodore (Stull, 1940, p. 78)

The two specimens mentioned in the Blanchard manuscript apparently have disappeared. A reading of Blanchard's handwritten notes makes clear his intention of sending the Irvington snake to the Brooklyn Museum, but he left a blank space for insertion of the shipping date, and conceivably the snake may not have been forwarded. The natural history

collection of the Brooklyn Museum was transferred to the American Museum of Natural History many years ago, but no *lodingi* from Irvington is now in its possession. The Dawes specimen was returned to Löding for deposition in the collection of the Charles Mohr Natural History Society at Mobile, where Löding had already placed at least one other specimen (Blanchard, 1920, p. 31). According to William Ziebach, of the Mobile Press Register and who recently investigated the matter for me, the Mohr Society no longer is in existence. Löding's personal collection was transferred to the Alabama Museum of Natural History many years ago, but Dr. Ralph L. Chermock, of the University of Alabama, advises (*in litt.*) that there were no specimens of *Pituophis melanoleucus lodingi* included among it.

LOUISIANA

Washington Parish

Near Bogalusa (Blanchard, MS; see section below entitled "Intergradation to the West")

MISSISSIPPI

Forrest County

7 miles south of Hattiesburg (M.S.C. No. 55-1)

George County

Southern part (Cook, *in litt.*)

Harrison County

No definite locality (M.C.Z. No. 33922)

Lauderdale County

East of Meridian, near Alabama state line (Cook, 1943, p. 23)

Perry County

15 miles southeast of Hattiesburg (A.M.N.H. No. 69047)

Perry and George counties

Leaf River Division, De Soto National Forest (M.G.F.M. No. Ar821-823)

Wayne County

Clara (Cook, *in litt.*)

RANGE: Based upon the above localities, the range of *Pituophis melanoleucus lodingi* may be stated as follows: southwestern Alabama, west of Mobile Bay and the Alabama River; southeastern Mississippi northward to Lauderdale County; and extreme eastern Louisiana (fig. 1).

SIZE AND SEX: If only those snakes that exceed a meter in length are counted, total length measurements (all should be considered as approximations) are available for 14 specimens of *lodingi*. These vary as follows: Eight males range from 1010 mm. to 1875 mm., with a mean of 1540 mm. Six females range from 1165 mm. to 1797 mm., with a mean of 1521 mm.

The tail length in males varies from about 13 per cent to 15.5 per cent

of the total length with the exception of the type (U.M.M.Z. No. 58800) which has a tail approximately 17 per cent of the total length; in females the tail varies from about 12.5 per cent to 14 per cent.

SCUTELLATION: Most of the scales of the body are strongly keeled, but the scales of some of the lowermost rows are smooth. Usually the four, five, or six lowermost rows are smooth on the neck and the two lowermost rows near the tail, but the counts are as low as three and as high as eight anteriorly and range from one to five posteriorly. Paired apical pits are usually readily apparent.

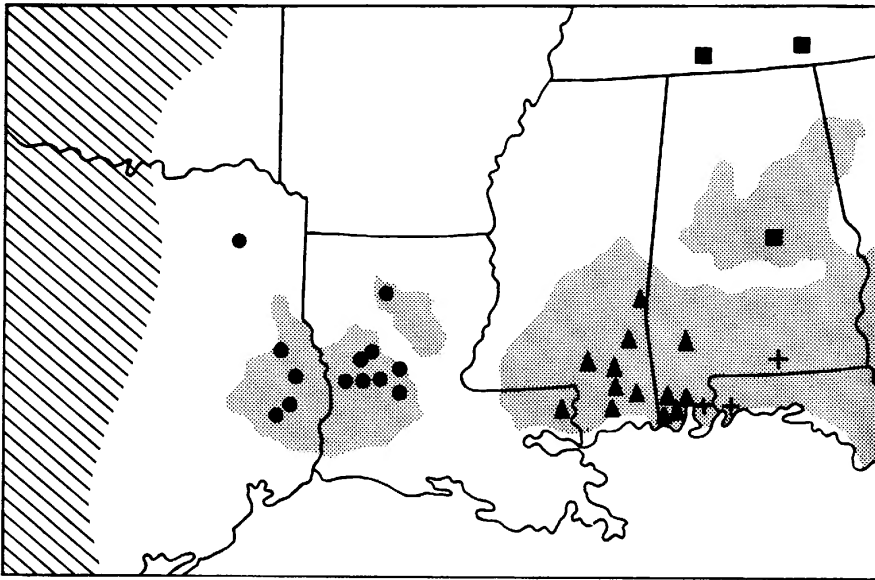


FIG. 1. Map of the mid-Gulf region showing locality records for *Pituophis melanoleucus ruthveni* (circles) and *Pituophis melanoleucus lodingi* (triangles). Other localities are shown as follows: crosses, specimens suggesting intergradation between *lodingi* and *mugitus*; squares, the nearest localities for *Pituophis melanoleucus melanoleucus*. The stippled areas indicate the approximate extent of the recent longleaf pine forests (according to Shantz and Zon, 1924, fig. 2). The hatched area indicates the range of *Pituophis melanoleucus sayi* in central Texas and adjacent Oklahoma.

The maximum number of scale rows among 18 specimens is 32, this count occurring in only one specimen; the maximum is 31 in seven, 29 in eight, and 27 in two. The minimum number of scale rows is 19, this count occurring in one specimen; the minimum is 20 in five, 21 in six, and 22 in six.

The data on the ventrals may be summarized as follows: males (10 specimens): 212 to 221, mean 215.8; females (eight specimens): 213 to

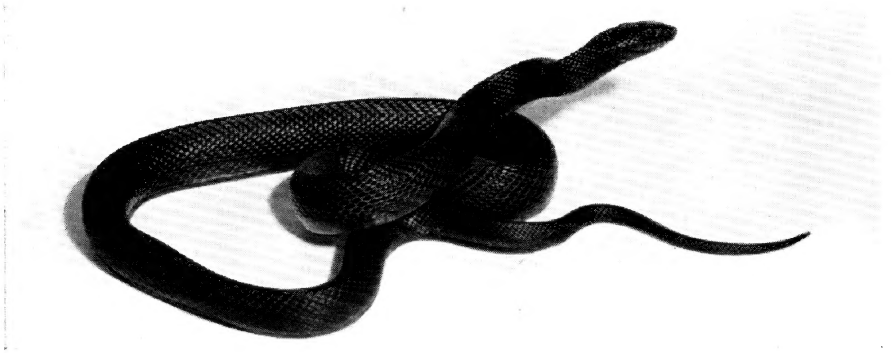


FIG. 2. *Pituophis melanoleucus lodingi*. (U.A.D.B. No. 56-1). Near Coffeetown, Clarke County, Alabama. Length, 1480 mm. Female.

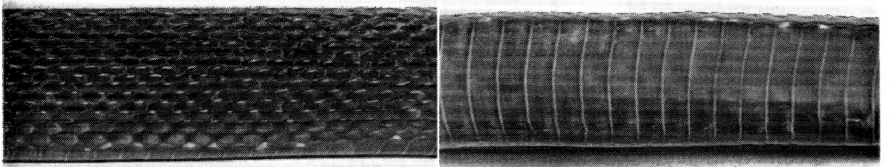


FIG. 3. *Pituophis melanoleucus lodingi*. (A.M.N.H. No. 74739). Near Mobile, Alabama. Sections of side of body (at left) and belly (at right).

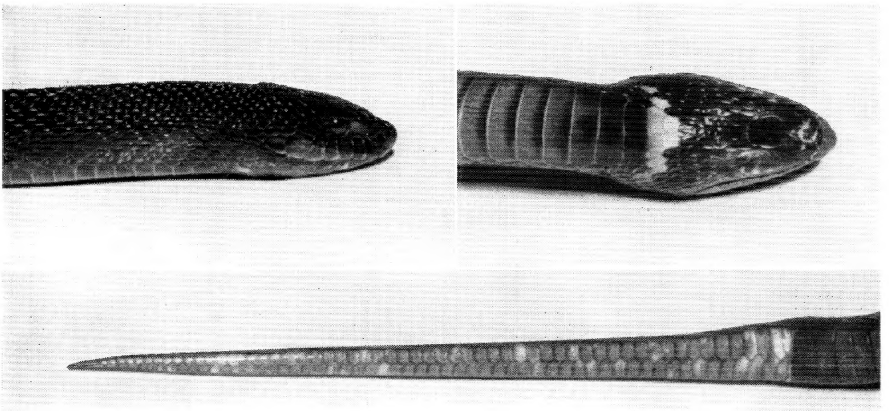


FIG. 4. *Pituophis melanoleucus lodingi*. Same snake as shown in figure 2. Side of head (upper left), chin and throat (upper right), and under side of tail (bottom).

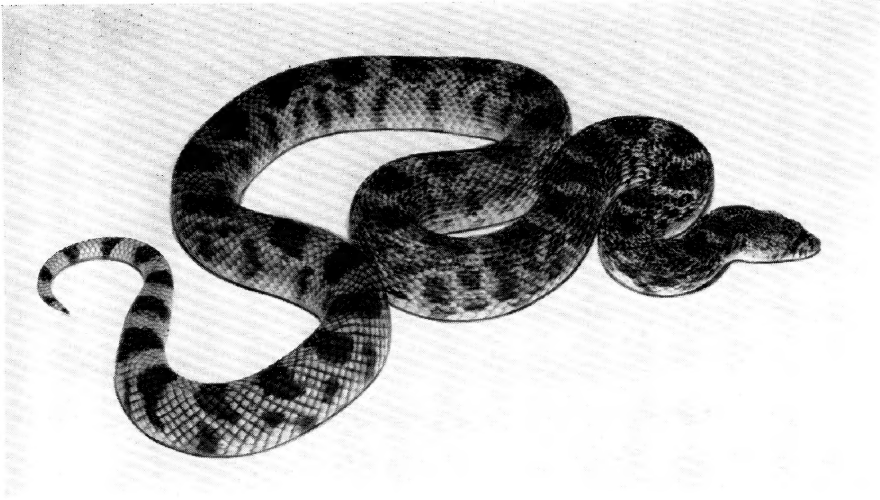


FIG. 5. *Pituophis melanoleucus ruthveni*. (K.U.M.N.H. No. 33973). Near Cypress, Natchitoches Parish, Louisiana. Length, 1590 mm. Female.

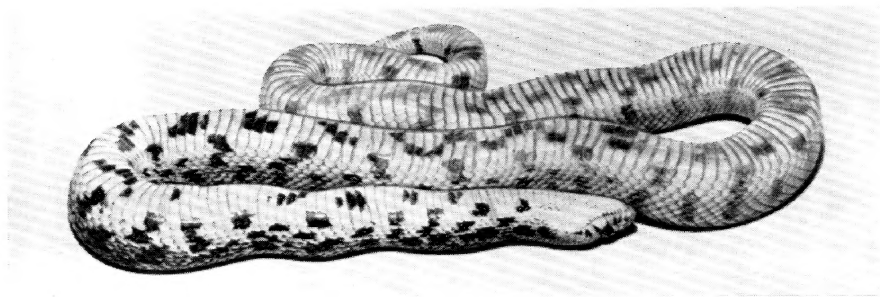


FIG. 6. *Pituophis melanoleucus ruthveni*. Same snake as shown in figure 5. View of under surfaces.

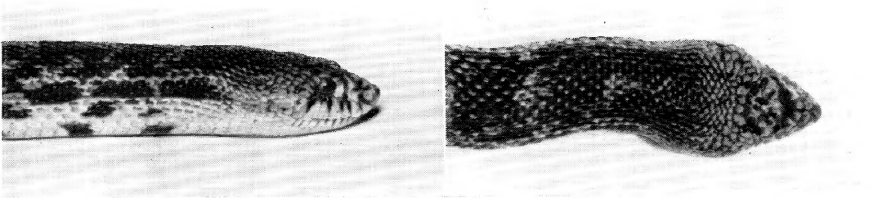


FIG. 7. *Pituophis melanoleucus ruthveni*. Same snake as shown in figures 5 and 6. Side of head (at left) and top of head (at right).

224, mean 217.1. The anal plate is single. The subcaudals vary as follows: males (nine specimens): 58 to 65, mean 62.4; females (seven specimens): 52 to 58, mean 55.3. The scale at the tail tip is usually long and spine-like, but varies in thickness.

The rostral is higher than wide, pointed posteriorly, and with its apex normally penetrating at least half of the length of the internasals. Normally there are four prefrontals, arranged in a transverse row and subequal in size. These scales are, however, subject to numerous abnormalities. They are often irregular in shape, and one or more of them may be split into anterior and posterior halves. A small loreal usually is present, but this scale may be reduced to tiny size or even be absent. Usually there is only a single preocular, but in one specimen there are two on both sides of the head. The distribution of the postoculars in a total count of 36 is 3 (22), 4 (13), and 5 (1). The temporals, because of their marked irregularity, were not counted.

Upper labials 7, 8, or 9; the distribution in a total count of 36 is 7 (1), 8 (28), and 9 (7). The fourth upper labial normally enters the eye, but when there is an extra anterior scale (resulting in a count of 9), the fifth labial is in contact with the orbit. The penultimate upper labial is usually the largest, but the one immediately preceding it may equal it in size. Lower labials 13 to 15; the distribution in a total count of 35 is 13 (21), 14 (11), and 15 (3).

COLORATION: Adults of *lodingi*, in general, are nearly uniform dark brown, sometimes almost black. But every one examined has at least some light-colored scales, indications of pattern, or both.

No very young specimens of *lodingi* are available for study, but the two smallest individuals (described in some detail below) show enough pattern to indicate that *lodingi* is basically a spotted snake, as are other forms of the genus. Melanism appears to increase with size and age and is manifest, in so far as can now be determined, in all members of the subspecies and not just among some individuals and/or local segments of the population as is the case with *Crotalus horridus horridus*, *Heterodon platyrhinos*, and some of the forms of *Natrix*.

In the darkest specimens of *lodingi*, the dorsum is nearly plain black, and light markings are at a minimum. Lighter individuals, i.e., those that are merely dark brown and do not approach black so closely, usually exhibit traces of pattern. The intensity of the dark pigment is greatest on the anterior part of the body, and, if pattern shows at all, it is invariably strongest on and towards the tail. When present, suggestions of pattern appear most commonly on the lower sides towards the rear of the body (or on the tail); blotches may be indicated by the merest of

traces, or they may be fairly definite, with some of them outlined by scales with pale edges.

The head usually bears brown or reddish brown pigment involving at least the snout and the sides of the head. The upper labials may be brownish and streaked, spotted, and outlined (at least along the sutures) with a darker hue. The chin and throat vary from black, with virtually no light markings, to light tan or yellowish, with a few dark markings.

The belly is uniform in coloration or nearly so; it varies from black to dark brown and may be darker than the dorsum, at least on the anterior part of the body. Even in the darkest specimens, however, light markings are often in evidence. These may take the form of light streaks or spots of varying size and degree of contrast with the dark ground color, but in every case the light markings are most prominent and most numerous towards the rear of the body. Sometimes some of the ventral scutes may have light edges where they meet the scales of the first dorsal row.

The tail usually shows more indications of pattern than any other part of the snake. Its ventral side may be mostly dark or mostly light; the dorsal side varies from almost plain black to so strongly patterned that the number of tail spots can be counted. Tail markings are in evidence on the snake portrayed by Haltom (1931, p. 46).

The light-colored, sometimes white, scales mentioned above do not occur in all specimens, but they may be present in even the darkest individuals. The snake from near Coffeetown (U.A.D.B. No. 56-1), for example, is almost black, but it has a nearly complete band of white across the throat, the band consisting of white *whole* scales (fig. 4). The same snake has white scales directly posterior to the anal plate and light-colored areas elsewhere beneath the tail. Light scales (whole scales or portions of scales) have been noted on the throat, chin, labials, and under the tails of other individuals.

Specimens that have been preserved for long periods of time or have been exposed to light tend to show more markings. This may account for Cook's statement (1943, p. 23) that one of her Mississippi specimens of *lodingi* "approaches" *muigitus*. I have not seen this snake, for it could not be found when Miss Cook very kindly sent me her material for study. Some of her other specimens showed marked evidences of fading.

That melanism is not necessarily associated with size (age ?) is attested by the fact that the largest *lodingi* on record is unusually light in coloration. This is a medium dark brown male (A.M.N.H. No. 74739), measuring 1875 mm. in total length, that was exhibited alive at the Philadelphia Zoological Garden for a short time.

The two smallest specimens of *lodingi* (as mentioned above), have the

pattern well indicated. One of these, now lost, was described in detail by Blanchard, and I quote the following from his manuscript: "This young specimen was collected about the first of June, 1924, by Dr. Van Aller at Irvington, Mobile County, Alabama, and sent alive to the writer by Mr. H. P. Löding. It was kept for some weeks and then preserved. . . . This specimen possesses 28 large dorsal blotches or saddles on the body and 7 on the tail, but the anterior 6 or 7 body blotches are too ill-defined to be counted with certainty. Posterior to the middle of the body they are very sharply defined. All the dorsal saddles reach down on the sides to the lowermost row of dorsal scales, except for the most anterior ones, which are too indefinite to delimit. The anterior saddles are emarginate in the median line, but the rest are little or not at all emarginate. There are obscure lateral alternating markings, transversely elongated, along the middle of the body. The lower surfaces are checked with dark quadrate spots with hazy margins." Blanchard's measurements for this snake (a female) were: total length, 565 mm.; tail length, 78 mm. I believe his mention of transversely elongated markings "along the middle of the body" means about halfway between head and tail and refers to lateral blotches situated low on the sides of the body and alternating with the larger dorsal blotches. Such an arrangement would be in keeping with the patterns exhibited by the other eastern representatives of the genus.

The other small snake, now in the Clemson College collection, is a male collected at Mobile by Löding in May, 1928; it measures 739 mm. in total length and 108 mm. in tail length. The anterior portion of the dorsum is plain, unpatterned dark brown, but posteriorly there are strong indications of pattern and nine dark cross bands can be counted. These are medium dark brown on a lighter brown background, and they extend from the first row of scales and the ends of the ventrals across the back to the other side. Counts were made on three of the cross bands; they measure six to eight scales wide at the midline of the back and six or seven scales wide at the level of the first row of scales on the sides. There are eight dark spots on the tail.

Including the two small specimens described above, counts of tail spots could be made on a total of five snakes; in three specimens there were seven spots each, one had six, and one had eight.

INTERGRADATION TO THE EAST: Two adult specimens of *Pituophis* from Baldwin County, Alabama, show pattern, one of them quite strongly so.

The first of these, a male from Silver Hill (M.C.Z. No. 47888) measures 1871 mm. in total length; tail, 229 mm. Scale counts are: dorsal rows 29-31-23, ventrals 226, subcaudals 64, upper labials 8-9, lower

labials 14, oculars 1-4. The anterior third of this snake resembles *lodingi*, at least dorsally. The posterior two-thirds could almost "pass" for *melanoleucus*. Anteriorly, the dorsum is dark brown, and the pattern is indistinct. Posteriorly, there are 16 large dark blotches on a light straw-colored background. The blotches are very dark brown towards the forward part of the body but turn to medium reddish brown towards the tail. These blotches are much darker and much more in contrast with the ground color than those normally seen in specimens of *mugitus* from Florida. The belly is plain light yellow but boldly marked with dark brown spots, these least numerous on the throat and on the posterior third of the body. The chin is mostly yellow, but with streaks and mottlings of brown, especially on the lower labials. The under side of the tail is immaculate yellow. This snake was identified as *Pituophis melanoleucus mugitus* by Shreve (1945).

The other specimen is a female from Barnwell, Alabama (C.M. No. 33857), that measures 1405 mm. in total length; tail, 191 mm. Its scale counts are: dorsal rows 29-32-23, ventrals 219, subcaudals 59, upper labials 9-8, lower labials 13, oculars 1-3. The coloration and pattern in this specimen approach typical *lodingi* fairly closely, but considerable pattern shows on the belly, the rear of the body, and on the tail. Indications of pattern are also evident throughout much of the length of the body, especially when the specimen is submerged in water or preservative. The chin and throat are cream-colored. The labials are brown and cream, the upper ones mostly brown and the lower ones mostly cream. The belly is boldly marked with dark brown and cream, the brown becoming more abundant posteriorly; the cream color encroaches upon the lowermost row of scales, especially near the tail. The under side of the tail is chiefly medium brown, but with many light marks.

These two snakes are best considered as members of an intergrading population separated from the main range of *lodingi* by Mobile Bay, plus the extensive delta of the Alabama River to the north which may be presumed to offer no habitats suitable for a *Pituophis*. On geographical grounds, intergradation with *mugitus* is assumed, especially because two specimens from farther east are intermediate in at least some respects. They are discussed below.

The recent report of Chermock (1955) of a *melanoleucus* from Chilton County, Alabama, introduces another and highly interesting possibility. Our knowledge of the distribution of *melanoleucus* has increased greatly in late years, the range creeping steadily westward with the discovery or reporting of new localities (Hibbard, 1937, p. 281; Savage, 1948; Chenoweth, 1949, p. 22; Conant, unpublished data). Proof may eventually

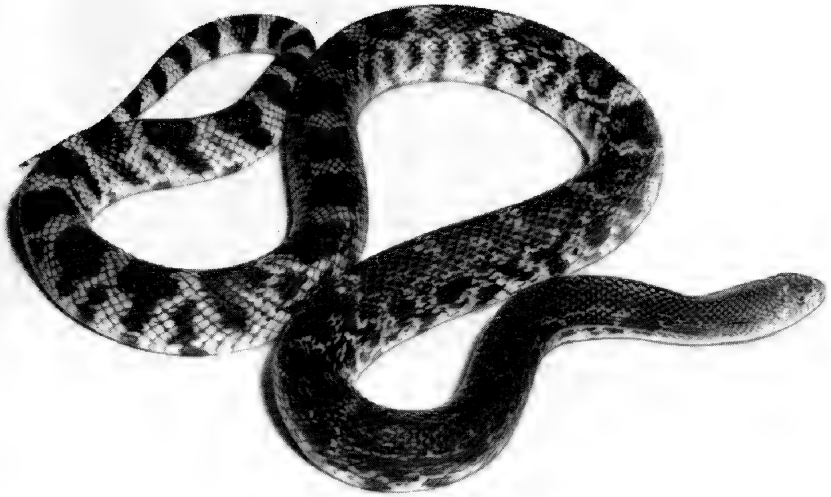


FIG. 8. *Pituophis melanoleucus ruthveni*. (A.M.N.H. No. 71080). Near Leesville, Vernon Parish, Louisiana. Length, 1470 mm. Male. Note light areas within some of the dark dorsal blotches.



FIG. 9. *Pituophis melanoleucus sayi*. Near Fort Worth, Tarrant County, Texas. Length, 1360 mm. Male.

be forthcoming that *lodingi* also intergrades directly with *melanoleucus*, but that must await the acquisition of additional specimens, a process that seems to be painfully slow everywhere in the East, except in a relatively few favored areas.

Through the courtesy of Mr. Wilfred T. Neill, of Silver Springs, Florida, I have had the privilege of examining a live *Pituophis* from 12 miles south of Andalusia, Covington County, Alabama (fig. 12). The following information is abstracted from my notes on the live animal: A

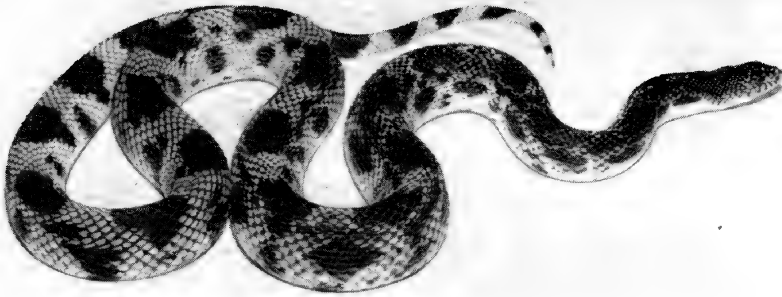


FIG. 10. *Pituophis melanoleucus melanoleucus*. Near Taunton Lakes, Burlington County, New Jersey. Length, 1630 mm. Female.

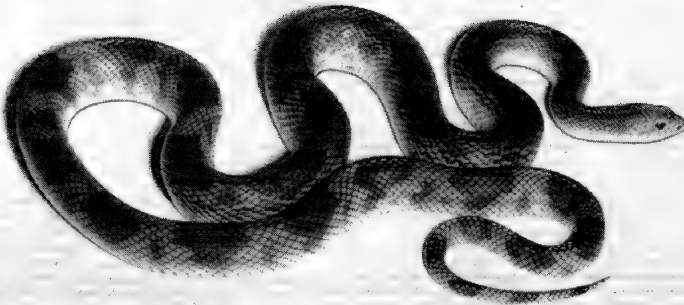


FIG. 11. *Pituophis melanoleucus mugitus*. Florida (exact locality unknown). Length, 1670 mm. Male.

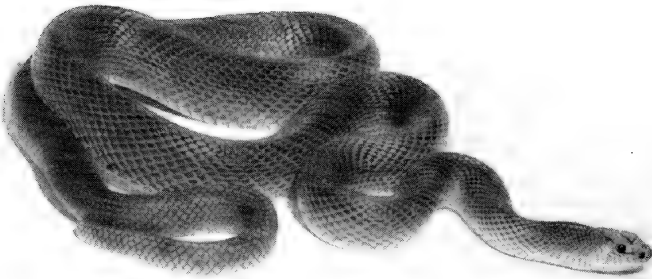


FIG. 12. *Pituophis melanoleucus*, a possible intergrade between *lodingi* and *mugitus*. Near Andalusia, Covington County, Alabama. Length, 1600 mm. (most of tail missing). Male.

virtually unicolored snake. It is tan and very similar in coloration to the rear portions and tails of many specimens of *Masticophis flagellum flagellum*. The tan is slightly darker at midbody than on the sides. Head lighter and without dark markings. A few scales or small groups of scales on the tail and hindmost part of the body are reddish and probably represent remnants of a spotted pattern such as is seen towards the posterior end of the body and on the tail of many *mugitus*. Belly uniform white except that the dorsolateral color encroaches onto the posterolateral corners of the ventral scutes. There are scattered light tan spots and smudges on the belly, but these are not very numerous. This Andalusia specimen is similar to *lodingi* in having virtually no pattern, but it also lacks the very dark pigment that is so characteristic of the black pine snake.

A specimen of *Pituophis* from Pensacola, Florida (M.C.Z. No. 47), might be considered as an intergrade but with strong tendencies towards *mugitus*. The posterior two-thirds of the body has a large amount of dark pigment on it, but fairly well-defined dark dorsal blotches and ventral spots are discernible.

There are several *Pituophis* in the collection of the Chicago Academy of Sciences from Grady and Thomas counties, in southwestern Georgia, that are also pale in coloration, but, although they are quite variable in matters of detail, they all show at least faint evidences of pattern. Neill (*in litt.*) states that specimens of *Pituophis* collected in the western end of the Florida panhandle "have been very pale, sandy, with no approach to *lodingi*." Probably all these snakes should be considered as representing color and pattern phases or local populations of the exceedingly variable *mugitus*. That form, as well as *melanoleucus*, is badly in need of a painstaking, critical study.

Tendencies towards melanism are found among populations of *Pituophis* in the East. Neill advises me that he has collected or seen several Florida specimens that were quite dark; at least one of them was uniformly sepia in coloration and without dorsal pattern. A very dark specimen of *melanoleucus* was recently found near Williamstown, Gloucester County, New Jersey (A.M.N.H. No. 75179). This snake is so dark that the pattern is obscured, and the interspaces between the black blotches, at least towards the rear of the body, are dark brown. The belly, however, is white and marked with the usual black spotting. The dorsum in the New Jersey population is normally pied black and white (or dark brown and white).

INTERGRADATION TO THE WEST: Evidence of intergradation between *lodingi* and *ruthveni* rests on a single snake that, unluckily, has apparently been lost. Percy Viosca, of New Orleans, acquired a specimen from near Bogalusa, Washington Parish, Louisiana, on April 15, 1932,

which originally bore his catalogue number 64-A. Viosca identified this snake as *lodingi*, and it, at least in part, was the basis for including this race in the fauna of Louisiana (Viosca, 1948, p. 2; 1950, p. 11). When he examined the Viosca collection in 1935, Blanchard made a record in his manuscript notes of a skin of a *lodingi* (about 1520 mm. long) from "South Pasture, Great South Lumber Co.," 7 miles southwest of Bogalusa, collected April 15, 1933. This was probably the same snake, even though the dates are different. I have twice written to Viosca asking whether the specimen is still extant, but apparently it has been lost. Viosca retained some of the unique material when his collection was turned over to Tulane University in 1950; it is certain that no Louisiana specimens of *lodingi* have reached the Tulane collection.

Fortunately, Blanchard, who was noted for his thoroughness, has left us a description of the Bogalusa snake. The following is quoted from his notes: "Dorsal rows 29-31-22, ventrals 215, subcaudals 51+, upper labials 8, lower labials 13, oculars 2-4, 3. Black above on anterior third of body, pattern gradually becoming visible on sides of body. About two-thirds of way back a pattern of broad spots, five or six scales long on the dorsal line and reaching to the 1st row, becomes visible all way around—very clear at posterior end. Belly mostly black, but well checked with white throughout."

This snake may have been responsible for the statement in Burt (1935, pp. 382-383) that "Mr. Percy Viosca, Jr., has informed me that certain eastern Louisiana specimens that he has seen are approximately intermediate between *ruthveni* and *lodingi*."

The Bogalusa snake, very dark and unpatterned at its anterior end (like *lodingi*) and spotted posteriorly (like *ruthveni*), could be interpreted as presenting some evidence of intergradation between these two subspecies. Contrariwise, it might be considered as either an aberrant or a faded *lodingi* in which the pattern was much more discernible than usual. It is extremely unfortunate that the specimen is not available for direct comparison with typical *lodingi*, and also with the two specimens from Baldwin County, Alabama (at the extreme opposite end of the range), that strongly suggest intergradation between *lodingi* and *mugitus*.

HABITAT AND HABITS: When the locality records for *lodingi* are plotted on a map (fig. 1), they all fall within the borders of the area that, before exploitation, was occupied by extensive longleaf pine forests (as delineated by Shantz and Zon, 1924, fig. 2). This is a region of largely sandy soils that once was dominated by longleaf pine (*Pinus palustris*) together with fewer numbers of shortleaf pine (*Pinus echinata*) and loblolly pine (*Pinus Taeda*).

Exasperatingly little has been recorded of actual habitats. There is the

statement in Blanchard (1924, p. 531), attributed to Löding, that specimens were taken in an area that "consists now mostly of Satsuma orange and pecan orchards, but was formerly fairly high and dry pine lands."

The first specimen that Löding sent to Blanchard (1920, p. 30) was "found dead on the Hall's Mill Road, in the vicinity of high sandy hills near Hall's Mill Creek."

Cook (1943, p. 22) states that "In July, 1940, the Pine Snake was observed more often than any other snake in the State Game Preserve, De Soto National Forest, Perry Co. [Mississippi]. Here, in cut-over pine lands where the soil is sandy and gophers, *Gopherus polyphemus*, dig holes, the Pine Snake seems to find adequate food and protection." She also commented (p. 23) on the habit of hissing loudly, pointing out that hearing this sound led to the discovery of two specimens.

The specimen from east of Coffeerville, Alabama, was collected July 6, 1954, by James E. Keeler who found it where "The topography was hilly, with sandy soil and a heavy forest association of *Pinus* sp. and *Quercus* sp. with fairly heavy undergrowth. The snake was caught while crossing a rural dirt road and was approximately 30 feet from a small stream."

The very large *lodingi* from 10 miles west of Mobile (A.M.N.H. No. 74739) was discovered by dogs. It held them at bay until the dogs' owner could bring up an empty oil drum and turn it upside down over the snake.

The three examples of *lodingi* that have been exhibited at the Philadelphia Zoo were all quite docile, seldom even hissing when handled. Two of them fed readily upon mice which they first constricted in their coils.

Pituophis melanoleucus ruthveni Stull

LOUISIANA PINE SNAKE

HISTORY: Stull described *ruthveni* in 1929 (pp. 1-3) as a subspecies of *P. melanoleucus*, basing it on two specimens from Rapides Parish, Louisiana, and naming it for Dr. Alexander Grant Ruthven, herpetologist and President of the University of Michigan. Burt (1935, p. 381) was the next to publish on this snake; he recorded a specimen from Zavalla, Angelina County, Texas. This is now No. 83676 in the collection of the United States National Museum. (Burt gave the number as 83672, which belongs to a specimen of *Elaphe obsoleta lindheimeri*, the "mixup" apparently resulting from a clerical error made at the time the two snakes were catalogued.) In her review of the genus *Pituophis* (1940, p. 76), Stull rejected Burt's record, stating that the specimen "should un-

doubtedly be referred to *sayi*, of which it appears to be a typical example." I cannot believe that she examined this snake, for I would identify it as *ruthveni*. In this same long paper, Stull added little to her original description, except to illustrate two sections of the body pattern of the type and to record her thoughts on the relationships of *ruthveni* to the other, and especially the eastern, forms of the genus.

Three additional specimens of *ruthveni* were reported from west central Louisiana by Fitch (1949, p. 89) in a paper on "road counts" of snakes. Although he mentioned the habitat, he did not publish specific localities. Two of these snakes were sent to me alive, and they were exhibited at the Philadelphia Zoological Garden.

Smith and Kennedy (1951), stimulated by the acquisition of a live specimen of *ruthveni* from Polk County, Texas, concluded that the genus *Pituophis* consists of a single polytypic species within the borders of the United States and proposed that all races from coast to coast be considered as subspecies of *melanoleucus*. They had knowledge at the time of only four specimens in addition to their live one: the two types, Burt's Zavalla snake, and another from Texas. This last they inferred to be *ruthveni* because of a statement in Brown's annotated check list of Texas "herptiles" (1950, p. 176) that a specimen taken in Nacogdoches County "may prove to be closely related to *Pituophis melanoleucus ruthveni*." Smith and Kennedy did not examine any of these specimens or compare them with their live individual. The sex of the latter, incidentally, is incorrectly stated in their paper, for dissection proves it to be a male.

Fugler (1955, p. 24) published the detailed localities for Fitch's specimens and for another one found in 1953 that has been deposited in the collection of the Museum of Zoology of Louisiana State University. Basing his conclusions on (1) the supposition of Smith and Kennedy that *ruthveni* and *sayi* should intergrade, and (2) his belief that the broad flood plain of the Mississippi forms a barrier between the ranges of *ruthveni* and *lodingi*, Fugler decided that the last-named forms belong to two different species and should be designated as *Pituophis catenifer ruthveni* and *Pituophis melanoleucus lodingi*.

When the several references above are studied and evaluated, it becomes obvious that two main factors have contributed to the taxonomic peregrinations of *ruthveni*: (a) the paucity of specimens and (b) differences of opinion on what constitutes a species or subspecies.

MATERIAL: All the snakes mentioned above I have examined and studied with the exception of one of Fitch's roadside specimens (which he did not preserve) and the paratype of *ruthveni*. The latter was in the

private collection of Percy Viosca, of New Orleans (Viosca No. 2), but it apparently has been lost. It was not found (or may have been discarded because of poor condition) when the Viosca collection was transferred to the custody of the Zoology Department of Tulane University in 1950. Stull pointed out as early as 1929 (p. 3) that the specimen was "badly" preserved. Several others have also been seen, some of which were sent to me alive in the early 1940's through the great kindness of Romeo Mansueti and Fred B. Ticknor who collected them while on bivouac in Louisiana during United States Army maneuvers. A complete list of the specimens I have been able to marshal, arranged in accordance with their localities, is as follows:

LOUISIANA

Natchitoches Parish

5 miles east of Bellwood (L.S.U.M.Z. No. 6203)

7 miles south of Cypress (A.M.N.H. No. 71079)

10 miles south-southwest of Cypress (K.U.M.N.H. No. 33973)

Rapides Parish

Livingston Refuge, 8 miles north-northeast of Alexandria (L.S.U.M.Z. No. 6387)

Longleaf (U.S.N.M. No. 76278, the type)

Vernon Parish

Camp Polk, east of Leesville (L.M.K. No. 38748)

6 miles north of Camp Polk (A.M.N.H. No. 69054)

3 miles northeast of Lacamp (A.M.N.H. No. 71198)

Near Leesville (A.M.N.H. No. 71080)

TEXAS

Angelina County

5 miles southeast of Zavalla (U.S.N.M. No. 83676)

Nacogdoches County

Nacogdoches (C.A. No. 5041)

Polk County

21 miles southeast of Livingston (J.P.K.)

Tyler County

Tyler Field (A.M.N.H. No. 68188)

Wood County

12 miles east of Quitman (A.M.N.H. No. 74788)

In addition to the above, there is a probable record in the literature for Hodge, Jackson Parish, Louisiana. In a paper on "Snakes of the hill parishes of Louisiana" (Clark, 1949, p. 251), which was extracted from Clark's master's thesis and edited by Hobart M. Smith, reference is made to two specimens under the heading of "*Pituophis* sp." These snakes apparently are no longer extant. Both Clark and Smith presumed them to be *sayi*, but, in his later paper with Kennedy (1951, p. 94), Smith

stated that the Hodge "bull snakes" are probably referable to *ruthveni*. In view of our present knowledge of the ranges of *sayi* and *ruthveni*, the latter interpretation is acceptable.

RANGE: Based on the localities listed above, the range of *Pituophis melanoleucus ruthveni* may be stated as follows: central western Louisiana and eastern Texas, chiefly in the longleaf pine belt, but also in the shortleaf pine-oak region of northeastern Texas (fig. 1).

SIZE AND SEX: Total lengths among the 14 specimens of *ruthveni* I have examined vary as follows: Ten males range from 1227 mm. to 1520 mm., with a mean of 1422 mm. Four females range from 1421 mm. to 1587 mm., with a mean of 1505 mm. Several of the snakes were so kinked or in such condition as to render accurate measurement impossible, hence the figures recorded above (and also the relative tail lengths noted below) should be considered as approximations. Clark (1949, p. 251) states that a specimen he collected measured 59 inches (1499 mm.) in length. He also gives a length of 87 inches for one killed at Hodge, Louisiana, but apparently this was the measurement for the skin and not for the animal in the flesh. Both of Clark's snakes presumably were *ruthveni* (as suggested above).

The tail length in males varies from about 13 per cent to 14 per cent of the total length; in females it is approximately 12 per cent.

SCUTELLATION: Most of the scales of the body are strongly keeled, but the scales of some of the lowermost rows are smooth. Usually the six lowermost rows are smooth on the neck and the two lowermost rows near the tail, but the counts vary from five to seven smooth rows anteriorly and one or two posteriorly. Paired apical pits are evident.

The maximum number of scale rows among the 14 snakes studied is 33, this count occurring in two specimens; the maximum is 31 in five, 29 in six, and 30 in one. The minimum number of scale rows is 19, this count occurring in three specimens; the minimum is 20 in two, 21 in four, 22 in one, and 23 in four.

The data on the ventrals may be summarized as follows: males (10 specimens): 212 to 219, mean 215.7; females (four specimens): 217 to 220, mean 218.3. The anal plate is single. The subcaudals vary as follows: males (nine specimens): 55 to 62, mean 58.3; females (four specimens): 45¹ to 53, mean 49.8. The terminal scale of the tail is normally long and spine-like, but it varies in thickness from moderately slender to rather stout.

¹ The snake with only 45 subcaudals has an abnormally short tail (10.4% of total length), but the scales are well formed, and a perfect terminal tail spine is present.

The rostral is higher than wide, pointed posteriorly and with its apex normally penetrating at least half of the length of the internasals. Usually there are four prefrontals, but these scales are subject to the same types of abnormalities as they are in *lodingi*. A small loreal is usually present. Normally there is only a single preocular, but in two specimens there is an additional very small lower preocular on one side of the head; in one of the same two snakes the preocular is split into three scales on the other side of the head, a small lower and a medium-sized upper scale being cut off from the main scale. The distribution of the postoculars in a total count of 28 is 3 (18), 4 (8), and 5 (2). The temporals, as are those in other snakes of this group, are both numerous and irregular, and accurate counts are difficult or impossible to make.

Upper labials 8 or 9, the distribution in a total count of 28 is 8 (21) and 9 (7). With one exception the fourth upper labial enters the eye when the total count is 8, and the fifth enters when the count is 9; the exception is in one snake wherein both the fourth and fifth enter on one side of the head and the fifth and sixth on the other. The penultimate upper labial is usually the largest (the seventh in those instances where there are counts of 8), but the last is the largest in one instance, and the penultimate may be equaled in size by the labial preceding it, or by the last labial, or by both. Lower labials 12 to 15, the distribution in a total count of 27 is 12 (6), 13 (14), 14 (3), and 15 (4).

PATTERN AND COLORATION: The blotched pattern, the most conspicuous feature of *Pituophis melanoleucus ruthveni*, is basically quite similar to the pattern of the eastern *melanoleucus* (fig. 10). The blotches are discrete and well defined towards the rear of the body and on the tail, but towards the neck they are crowded and so frequently run together that making an accurate count may be impossible and the total number must be estimated. There is a tendency in *ruthveni* for the blotches of the neck and sometimes a few of those at midbody to be invaded by spots, short streaks, or even patches of the ground color. This condition is probably the source of the "subdivided blotches" mentioned by Smith and Kennedy (1951, p. 93) and Fugler (1955, p. 24). The light areas in the dark blotches may be clearly evident (fig. 8), faint, or (most often) entirely absent. They are of no apparent diagnostic value.

The ground color between the blotches is a deep olive-buff to medium olive-gray on the anterior part of the body, but becomes lighter and brighter (often a rich light buff) posteriorly and on the tail. All these color values and those that follow are based on examination of live specimens.

The coloration of the blotches on the anterior part of the body varies

from medium dark brown to virtually black. Posteriorly the blotches become lighter and richer in tone. At midbody they are brown, but towards and on the tail they change to a strong reddish brown. The reddish coloration was evident in all the specimens seen alive, and it has been mentioned in the literature in the descriptions of other live or freshly preserved snakes. The reddish tone may, however, soon disappear in preservatives. The smaller dark spots on the sides of the body show changes in coloration similar to those of the larger blotches, but near the tail the lateral markings are even more reddish. There is a strong tendency for dark lateral markings to run together to form a longitudinal stripe or a series of short dark lines on the sides of the neck (fig. 7). This tendency towards development of a dark neck stripe is of common occurrence in *Pituophis melanoleucus melanoleucus*.

Among 12 specimens of *ruthveni*, the total number of dorsal blotches, counting from a point directly above the anus to, but not including, the head, varies from 30 to 42, with a mean of 34.9.

The size of the dorsal blotches, in terms of number of scales involved, varies, in general, with their position on the body. The more anterior blotches are 4 to 6 scales long (in the longitudinal axis of the snake) and 11 to 14 scales wide. Near midbody they are $3\frac{1}{2}$ to 6 scales long and 9 to 12 scales wide. Near the tail they are 3 or 4 scales long by 11 to 13 scales wide; the increase in width towards the rear of the body is accounted for by the fusing of lateral spots with the dorsal blotches.

The number of dark spots on the tail in *ruthveni* may be summarized as follows: males (10 specimens): 7 to 10, mean 9.2; females (four specimens): 7 or 8, mean 7.25.

The head in *ruthveni* is devoid of any constant regular pattern. In general, the dorsal surface of the head is profusely marked with small dark spots that, in one live individual, were dark brown and reddish brown on a ground color of buff. In many specimens, however, there are definite traces of one or more of the type of head markings that are more or less characteristic of *sayi* (the bullsnake). These are: (1) a dark line from the eye to the angle of the jaw; (2) a light stripe above and paralleling the dark line; (3) a dark subocular line, wider and more conspicuous than the other maculations on the upper labials; and (4) a dark line across the head between the eyes (the line involving the anterior edges of the frontal and the supraoculars plus the posterior edges of the prefrontals and the uppermost corners of the preoculars). Of these markings, the first three are of rare occurrence in *ruthveni*, but the dark line between the eyes is at least faintly indicated in two-thirds of the specimens examined. As the head markings are most conspicuous in juveniles

of *sayi*, young individuals of *ruthveni* may have better defined head patterns. None is now available for study. Some large adults of *sayi* have obscure head markings.

The ground color of the ventral surface is a yellowish buff, strongest and richest on the chin and throat. There may be a faint wash of pale purplish brown down the center of the belly. In the region of the neck, the ventral spots vary from black to chestnut edged with black; farther posteriorly they are plain dark brown but still clear-cut in appearance; under the tail and usually on at least the posterior half of the belly they become much less distinct. The most posterior of the ventral markings may be orange-brown, in keeping with the richer coloration of the dorsal markings in the region of the tail.

Some of the preserved specimens at hand are, in general, darker and with the coloration considerably less rich. If the description of live material above were to be likened to a color photograph, then the darker snakes might be said to resemble black-and-white photographs of the same subjects. The dark appearance, in most instances, probably is the result of the methods and materials used in preservation and/or the condition of the animal at the time. There is good evidence to indicate, however, that certain specimens of *ruthveni* may be darker and less richly colored in life. Some may have the dorsal blotches nearly the same color throughout the length of the body and tail.

COMPARISON OF *ruthveni* WITH *sayi*: Some persons apparently have encountered difficulties in distinguishing between *ruthveni* and *sayi*, an understandable situation in view of the scarcity of specimens of *ruthveni*. To facilitate comparison of the two forms, the more usual differences between them are summarized in table 1. As might be expected in two so closely related snakes, there is some overlapping of characters. If this fact is borne in mind and due allowance is made for individual variation, identification is not difficult.

The number of dorsal blotches (counted from directly above the anus to, but not including, the head) is of diagnostic value. Counts for *ruthveni*, as stated above, vary from 30 to 42, mean 34.9; comparable figures for *sayi* are 39 to 66, mean 51. In *ruthveni*, the dorsal blotches tend strongly to run together in the neck region; they are darkest on the anterior part of the body and usually are reddish near and on the tail. In *sayi*, the dorsal blotches usually are well separated and easily counted (fig. 9); they may be equally dark throughout, but very often they are darkest and richest at the two extremes—on the neck and near and on the tail. Differences in head pattern are discussed under the description of *ruthveni*.

The statistical data presented in table 1 for *ruthveni* are based entirely

TABLE 1

COMPARISON OF *Pituophis melanoleucus ruthveni* WITH *Pituophis melanoleucus sayi*

Character	<i>ruthveni</i> (Data from 14 Specimens)	<i>sayi</i> (Data from 50 Specimens ^a)
Ventral scales	Range, 212-220 Mean, 216.4	Range, 215-244 Mean, 227.6
Dorsal blotches (number)	Range, 30-42 Mean, 34.9	Range, 39-66 Mean, 51.0
Tail spots (number)	Range, 7-10 Mean, 8.6	Range, 10-18 Mean, 13.1
Dorsal blotches (coloration)	Darkest in neck region; becoming lighter and richer and turning reddish brown on and near tail. Blotches crowded and often confluent in neck region	Darkest in neck region and on and near tail; median blotches lighter and richer. Often dark throughout length of body. Blotches usually discrete on neck as well as posteriorly
Postocular dark line	Absent	Present
Light stripe above dark line	Absent	Present
Dark subocular line	Absent	Present
Dark line across head	Sometimes present; often only slightly indicated; sometimes absent	Present

^aStatistical data are from 50 specimens; statements concerning pattern are from the literature and the author's personal examination of random samples of *sayi*.

on my own studies; those for the 50 specimens of *sayi* have been assembled from two sources: (1) personal examination of six small specimens from Dallas County, Texas, lent to me by Mr. Lawrence Curtis from his private collection; and (2) the scale counts published by Stull (1940, pp. 114-122). In the latter case, figures were tabulated for the first 25 specimens listed by Stull from Oklahoma that were accompanied by information mentioning at least a town or county; figures were also tabulated for 19 specimens from Texas that were accompanied by similar data. The data on pattern in *sayi* were obtained from the literature, from examination of live specimens in the Philadelphia Zoo, and from a random check of material in the collection of the Academy of Natural Sciences of Philadelphia.

I am unable to detect any difference in the size or shape of the rostral plate that would serve to distinguish *ruthveni* from eastern specimens of *sayi*. In this scale character, specimens of eastern *sayi* are much closer to the pine snakes than they are to the western gopher snakes that normally have broad rostral plates.

In point of habitat, *ruthveni* occurs chiefly in pine woods, whereas *sayi* is essentially a snake of plains and prairies.

A modern and critical review of *sayi* is needed. Although Klauber (1947) monographed the western members of the genus, he stated in his introduction that he would touch upon *sayi* only incidentally. Stull summarized *sayi* in her doctoral thesis (1940), but, as Klauber has pointed out (1941, p. 57), most of her paper was written prior to 1929. A large amount of material has accumulated in the intervening years.

HABITAT AND HABITS: Virtually all records for *ruthveni* fall within the area originally occupied by the longleaf pine forests (map, fig. 1). Although this region has been vastly altered by human activities, its sandy soils and general environment still offer many habitats suitable for *Pituophis*. The Texas portion of the longleaf belt, according to Tharp (1939, p. 2), is "a sandy region of low-lying hills interspersed with 'crawfish' flats, subject to 45 to 50 inches of rainfall and traversed by numerous creeks and rivers."

To date only a single specimen of *ruthveni* (A.M.N.H. No. 74788 from Wood County, Texas) has been collected outside the longleaf belt. Lawrence Curtis made a special trip to the locality, in the company of Mr. and Mrs. J. W. Pittman who caught the snake, and he describes the area as "a dense woodland composed primarily of shortleaf pine and post oak." Curtis also states, "Although there is longleaf pine scattered around the area, all evidence that I know indicates that it is not native but introduced."

The Wood County locality lies in the Pine-Oak forest region which Tharp (1939, p. 37) states "is characterized by the large number of species of trees . . . Especially is this true of the oaks and hickories . . . On sandy uplands sweetgum is frequently co-dominant with short-leaf or loblolly pine."

At the time Dr. Henry S. Fitch sent the two live specimens to me in 1948, both of which he had collected on the Red Dirt National Wildlife Refuge in Natchitoches Parish, Louisiana, he wrote as follows: "Both these snakes were found by me crossing roads in late afternoon on cloudy days. They were in open woods of longleaf pine and oak (*Quercus marilandica* and *Q. incana*) in sandy upland, where burrows of pocket gophers (*Geomys breviceps*) were abundant. One snake had dust and cobwebs adhering to its face as if it had just emerged from a burrow.

"On the same day the smaller of the two snakes was found, I noticed the dried carcass of another on the road only a few hundred yards from it. This one was picked clean of flesh and skin by the vultures, except for a few inches of the tail. About a year ago I found another DOR in similar habitat about 32 miles farther south [now L.M.K. No. 38748]. These four are all that I have come across in several thousand miles of driving through the Kisatchie National Forest and adjacent parts of central Louisiana. I have done considerable field work within a few miles (north and west) of the type locality without seeing any there."

Fitch further advised me that "Mr. James Dodds, a U. S. Forest Service man who lives just west of the Red Dirt Refuge, has seen several, all on dry sandy ridges, and that they were mostly at the entrances of burrows, into which they withdrew when disturbed. Mr. Colon Russell, the Federal Game Warden on the Refuge, says he has never seen one on the refuge, but has seen three on a small farm near Cypress."

Romeo Mansueti found two of these snakes in open fields in Vernon Parish, Louisiana. One was taken as it emerged from a hole in sandy soil that had contained a pine tree stump. The surrounding terrain was rolling, grassy, and strewn with burned pine logs and stumps; there were a few scattered standing trees; small deciduous groves and several "boggy" areas were near by. Another was caught as it "crawled over a man's chest as he lay beneath a pine tree in the shade." This was on the Camp Polk mortar and machine gun range which had been leveled off and was devoid of grass.

The specimen from Polk County, Texas, was sunning at the side of a small sandy road in an area "characterized by its predominantly sandy soil and the forests of long-leaf pine with mixed hardwoods" (Smith and Kennedy, 1951, p. 93). The one from Angelina County, Texas, was

taken "on the road near a plot of grass . . . in the sandy cut-over pine barren region of eastern Texas" (Burt, 1935, p. 381). The specimens reported by Clark (1949, p. 251) were taken in second-growth scrub timber or cut-over land. Clark also states that the paratype (from Longleaf, Louisiana) was collected in second-growth timber.

Fitch (1949, pp. 87–88) has summarized some of the factors that may have contributed to the rarity of *ruthveni* by stating, "It is universally agreed by natives and longtime inhabitants of the general region that snakes are far less abundant now than in past decades of the present century. Deforestation of west-central Louisiana has occurred mostly since 1920. Removal of the longleaf pine woods, and frequent burning of the grasslands which replaced them have altered the original habitat in a way that is unfavorable for most wildlife species, including snakes. The gradual increase in the human population has resulted in increasing pressure on the native wildlife, so that most of the larger reptiles, birds, and mammals are nearly exterminated, or have become scarce and localized . . . During the early part of the present decade the activating of army camps in Louisiana and the large scale army maneuvers led to concentrations of humans in places hitherto but thinly populated. Slaughter of snakes took place on a large scale, and may have effected drastic reductions in numbers of some of the more conspicuous kinds, at least. Ever since this region was first settled, range hogs have roamed the woods and have been an important factor in their ecology. They are known to feed on snakes, including the venomous species."

Another factor and one that would help to account for the apparent scarcity of both *ruthveni* and *lodingi* is the inherent tendency for pine snakes to hide, to take refuge in burrows and cavities or beneath vegetation, or to burrow into the arenaceous substratum. Although I personally have never encountered either of them in the field, it is probably safe to presume their habits, in part, at least, are similar to those of the eastern *Pituophis m. melanoleucus*, with which I have a somewhat more than passing acquaintance. Finding *melanoleucus* is largely a matter of chance. It is a common and widespread snake in the pine barrens of southern New Jersey, where I live, but it is not often encountered. Although one may go afield repeatedly or drive hundreds of miles over pine barrens roads, two or three specimens a season is a good average. I would be at a loss to suggest any one place where I could guarantee to find *melanoleucus* even during a week of intensive collecting.

None of the live snakes collected by Fitch or Mansueti made any attempt to bite, but they thrashed about vigorously in their efforts to escape. Loud hissing was also a part of their behavior pattern. Mr. and

Mrs. J. W. Pittman, who collected the specimen in Wood County, Texas, state that the snake "pushed his head up as high as he could and blew or hissed—more of a blowing sound."

Residents of west central Louisiana who are interested enough to distinguish one serpent from another call *ruthveni* the "bull" snake.

The four specimens that have been exhibited in the Philadelphia Zoological Garden fed well on mice and sparrows. One of them waxed fat and survived for six years, six and one-half months before succumbing to an anal infection. It became quite docile in captivity. Food was invariably constricted before being eaten.

SYSTEMATIC POSITION: The Louisiana pine snake is the link between the pine snakes of the East and the bullsnake and gopher snakes of the West. Three allopatric forms occur east of the range of *ruthveni* (*Pituophis melanoleucus melanoleucus* and the subspecies *mugitus* and *lodingi*). Intergradation between *melanoleucus* and *mugitus* can be easily demonstrated, and intergradation between *lodingi* and other eastern races is at least strongly indicated. Klauber, in his extensive review of the western gopher snakes (1947), recognized five mainland races (*Pituophis catenifer catenifer* and the subspecies *annectens*, *deserticola*, *affinis*, and *sayi*), with ample evidence of intergradation among them.

Both morphologically and geographically, *ruthveni* lies between the eastern and western forms, with *lodingi* its nearest neighbor towards the east and *sayi* towards the west. There is no evidence that it intergrades with *sayi*, and there is only the missing Bogalusa snake to suggest that intergradation may take place between *ruthveni* and *lodingi*. There is no positive proof of the latter, however, and it is here assumed that intergradation between *ruthveni* and both of its two closest allopatric relatives, *lodingi* and *sayi*, remains to be demonstrated.

The ranges of *ruthveni* and *lodingi* are separated by the broad alluvial plain of the Mississippi River which probably, as Fugler (1955, p. 24) has suggested, serves as a barrier to contact between them. Both of these snakes are partial to sandy areas and pine woods. The alluvium, the swamps, and the periodic flooding to which the big river valley is subjected would combine to form an unsuitable habitat. The actual gap between the ranges of *ruthveni* and *lodingi*, based on presently known localities, is approximately 150 miles and not "more than 250 miles" as stated by Fugler (*loc. cit.*). It is possible that future collecting may narrow the gap considerably, for the disjunct portions of the longleaf pine belt are not too widely separated (see map, fig. 1).

Towards the west, the recent acquisition of a specimen of *ruthveni* from Wood County, Texas, reduces the gap in range between *ruthveni*

and *sayi* to an airline distance of less than 100 miles. In terms of vegetational provinces, only the relatively narrow Oak-Hickory region lies between them (Tharp, 1939, map). Whether or not either form penetrates this region remains to be demonstrated. Like most vegetational and physiographic regions, the Oak-Hickory of Texas is (and was) not an unbroken stand, even in pre-pioneer days. As Tharp (1939, p. 35) states, the line of contact between the Oak-Hickory and the Black Land Prairie to the west "is exceedingly sinuous with mottes of timber standing as islands in the prairie and with embayments of prairie lying both between peninsular timber strips and as 'lakes' well within the timbered region." Tharp further states that grassland islands occurred even within the Pine-Oak region wherein *ruthveni* recently has been taken.

Conversely, fragments of the Pine-Oak forest are separated from the main portion by a considerable strip of Oak-Hickory. These fragments are in Bastrop, Lee, and Caldwell counties. "They are thought to be relict remains of a once much more extensive forest which existed when the humid area extended much farther westward than at present" (Tharp, 1939, p. 38). Hence the habitats of *ruthveni* and *sayi* approach each other closely and may even overlap.

Among the specimens now available, there is none that shows characters branding it indisputably as intermediate between *ruthveni* and *sayi*. Hence intergradation between these two cannot be demonstrated. Yet they obviously are closely related, and future collecting may prove a complete overlapping of characters. The possibility also cannot be overlooked that an interdigitating type of intergradation may occur such as is evidently the case between two of the forms of *melanoleucus* in the East. In the region where *melanoleucus* and *mugitus* come together, notably in South Carolina, specimens are found in the same region that are identifiable with *melanoleucus*, others that are identifiable with *mugitus*, and still others that are intermediate in one or more characters. Conceivably, a similar situation may exist between *ruthveni* and *sayi*.

Burt (1935, p. 382) and Smith and Kennedy (1951, p. 96) inferred intergradation between *sayi* and *ruthveni*, and Fugler (1955, p. 24) assumed it. None of these authors, however, offered any concrete proof that intergradation does take place.

Without proof of intergradation, one could state that there are, in essence, three separate groups of the genus *Pituophis* in the United States; these might be classified taxonomically as three separate species, viz.:

1. *Pituophis melanoleucus*, with three subspecies, including *lodingi*
2. *Pituophis catenifer*, with several subspecies, including *sayi*
3. *Pituophis ruthveni*

An alternate interpretation would be to presume that intergradation would take place, if the ranges of *ruthveni* and its nearest neighbors of the same genus could be brought together. This would be in conformance with the polytypic species concept as enunciated by Mayr (1942, p. 111). Such an interpretation would result in making the genus *Pituophis* consist of a single species extending from coast to coast and consisting of nine subspecies of *melanoleucus* within the borders of the United States (*affinis*, *annectens*, *catenifer*, *deserticola*, *lodingi*, *melanoleucus*, *mugitus*, *ruthveni*, and *sayi*). This arrangement was proposed by Smith and Kennedy (1951, p. 96), and it is the one that I recommend be adopted.

The overlap in scale counts, the overlap in the number of spots and blotches, and the elements of the head pattern of *sayi* that occasionally appear in *ruthveni* all are indicative that the snakes of the two populations behave as subspecies and not as species.

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